DOCUMENT RESUME

ED 247 084 SE 044 679

AUTHOR	Palumbo, Thomas J.
TITLE	Selected Characteristics of Persons in Engineering: 1978.
INSTITUTION	Bureau of the Census (DOC), Suitland, Md.
SPONS AGENCY	National Science Foundation, Washington, D.C.
PUB DATE	Jun 84
NOTE	36p.; For other documents in this series, see ED 168 820, ED 205 394 and ED 229 231. Document contains small and light print.
AVAILABLE FROM	Superintendent of Documents, Government Printing Office, Washington, DC 20402.
PUB TYPE	Collected Works - Serials (022) -- Reports - Research/Technical (143) -- Statistical Data (110)
JOURNAL CIT	Current Population Reports; Series P-23 n135 Jun 1984
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Educational Background; *Employment Experience; Employment Level; *Engineering; Engineering Education; *Engineers; Higher Education; Occupational Mobility; Occupational Surveys; *Personnel Data; *Salaries
IDENTIFIERS	National Science Foundation

ABSTRACT

This report is the seventh in a series of reports based on data collected in the 1978 National Sample of Scientists and Engineers survey. Profiled are the characteristics of 721,158 persons represented in the national sample's field of engineers. Characteristics are discussed under five headings: (1) composition (sex, age, regional/racial distribution); (2) education and training; (3) professional experience and growth of field, focusing on years of professional experience, field of engineering in 1976, and job mobility in 1978; (4) labor force participation; and (5) income, focusing on basic annual salary rate of full-time employed engineers in 1978. Text material is supplemented by statistical data presented in three text tables, three charts, and individual tables related to each of the five areas. Survey methodology (including questionnaire used and response rates) is provided in five appendices. Among the findings are indications of a predominantly male (99.6 percent), white (about 96 percent) sample with a median age of 47 years. In addition, 92 percent were in the labor force, and of those not in the labor force, 94 percent were retired. The 1978 basic salary rate of full-time employees was $27,275. (JN)

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CURRENT POPULATION REPORTS

Special Studies
Series P-23,
No. 135

U.S. Department of Commerce
BUREAU OF THE CENSUS

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Selected Characteristics of Persons in Engineering: 1978

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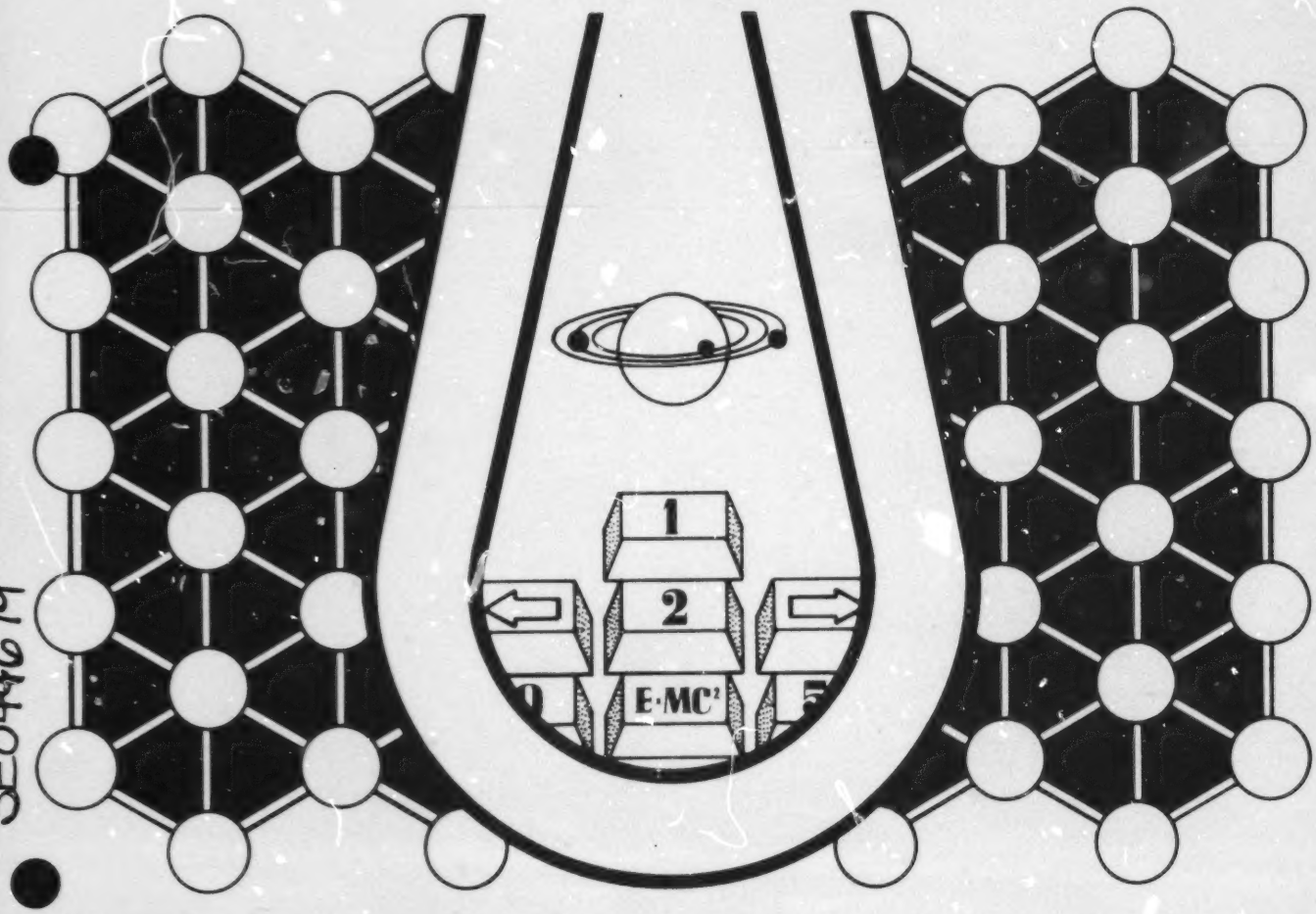

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CURRENT
POPULATION
REPORTS

Special Studies
Series P-23, No. 135
Issued June 1984

Selected Characteristics of Persons in **Engineering:** 1978

by
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ACKNOWLEDGMENTS

The 1978 National Survey of Natural and Social Scientists and Engineers was sponsored by the National Science Foundation, as part of the Manpower Characteristics System, and conducted by the Bureau of the Census.

The principal participants for the National Science Foundation in developing and coordinating the survey were **J. James Brown**, Study Director, Demographic Studies Group, and **Alan Fechter**, Head, Scientific and Technical Personnel Studies Section, both members of the Division of Science Resources Studies. Assistance was provided by **Nancy M. Conlon**, Analyst, Manpower Characteristics Studies Group.

At the Bureau of the Census, **Anita Chiera** and **Jane Ingold**, both of Labor Force Statistics Branch, Population Division, had primary responsibility in planning and conducting the survey. The systems and processing procedures and programs were developed by **Ann M. Gifford** and **Patricia L. Marks**, of Population Division. Statistical assistance was provided by **Sharon A. Schoch**. Overall direction was provided by **Gordon Green**, Assistant Division Chief (Socioeconomic Statistics Programs), Population Division, and **Paula J. Schneider**, then Chief, Labor Force Statistics Branch, Population Division.

SUGGESTED CITATION

U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 135, *Selected Characteristics of Persons in Engineering: 1978*, U.S. Government Printing Office, Washington, D.C., 1984.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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SYMBOLS USED IN TABLES

–	Represents zero.
X	Not applicable.
Z	Less than 0.05 percent.
*	Based on fewer than 20 sample cases.
27+	The median fell in the category 27 weeks or more.

Related Materials

Statistics from a related survey, the 1972 Professional, Technical, and Scientific Manpower Survey, are found in U.S. Bureau of the Census, Technical Paper No. 33, *Characteristics of Persons in Engineering and Scientific Occupations: 1972,* and U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 45, *Persons in Engineering, Scientific, and Technical Occupations: 1970 and 1972.*

The Census Bureau report based on the results of the 1974 National Survey of Scientists and Engineers is U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 53, *Selected Characteristics of Persons in Fields of Science or Engineering: 1974.* The Census Bureau report based on the 1976 survey is U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 76, *Selected Characteristics of Persons in Fields of Science or Engineering: 1976.* This is the seventh report in a series of reports based on the 1978 survey; the first report in the Series was U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 108, *Selected Characteristics of Persons in Physical Science: 1978.*

For a list of the National Science Foundation reports based on the above-mentioned 1972 and 1974 surveys, see National Science Foundation, *Characteristics of the National Sample of Scientists and Engineers 1974, Part III* (NSF 76-330); and National Science Foundation, *U.S. Scientists and Engineers: 1974* (NSF 76-329). Two National Science Foundation reports based on the results of the 1976 National Survey of Natural and Social Scientists and Engineers are Science Resources Studies Highlights, *National Sample of Scientists and Engineers: Changes in Employment, 1972-1974 and 1974-1976* (NSF 77-322); and *Characteristics of Experienced Scientists and Engineers, 1976* (NSF 78-305). A National Science Foundation report containing results from the 1978 survey, along with other data from the Manpower Characteristics System, is *U.S. Scientists and Engineers 1978* (NSF 90-304).

SELECTED CHARACTERISTICS OF PERSONS IN ENGINEERING: 1978

INTRODUCTION

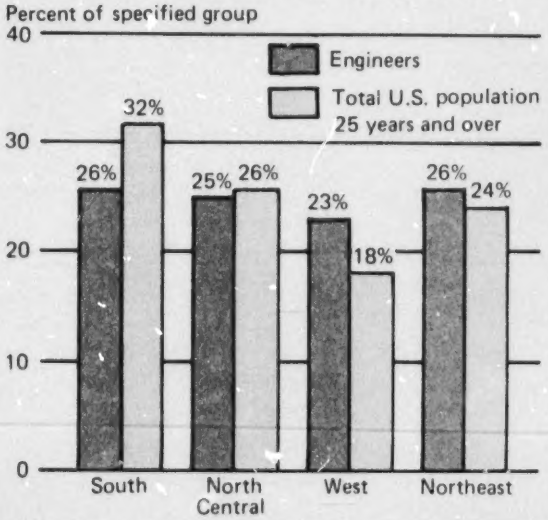
The statistics in this report are based on the 1978 survey in a series of biennial surveys known as the National Sample of Scientists and Engineers. The series was sponsored by the National Science Foundation and conducted by the Bureau of the Census. The series began with the 1972 Professional, Technical, and Scientific Manpower Survey, with follow-up surveys of persons from the 1972 survey conducted in 1974, 1976, and 1978. All persons in the National Sample were experienced workers who either had jobs in 1970 or were looking for jobs; new entrants into the labor force since 1970 were not included. Thus, almost all of the sample persons were 30 years old and over in 1978. In addition, the fields of science and engineering in the National Sample were limited to persons who met strict educational, occupational, and professional qualifications. For these reasons, persons in the 1978 National Sample represented approximately 1.5 million scientists and engineers, only a part of the Nation's total scientific and engineering work force. (The Department of Labor estimated that, based on occupational qualifications alone, there were 2.4 million scientists and engineers in the United States in 1978).[1]

This report is the seventh and final in a series of reports based on the 1978 survey. Profiled here are the 721,158 persons represented in the National Sample's field of engineers.

COMPOSITION (Table 1)

- Nearly all (99.6 percent) of the engineers represented in the National Sample were men. In addition, most of the engineers in the sample were White (about 96 percent). Only about 2 percent of the engineers were Chinese, Japanese, or Korean, and less than 1 percent were Black. A small percentage (1.5 percent) reported their ethnic origin as Hispanic.
- The median age of the engineers was 47 years in 1978.
- The engineers represented in the National Sample were more likely to live in the West and less likely to live in the South in 1978 than the general population of the United States 25 years and over (figure 1).[2] The proportions of engineers who lived in the Northeast and the North Central were similar to those of the general population.
- There were 17 fields of science or engineering (S/E) represented in the National Sample (figure 2). These fields are more strictly defined categories than occupations. In general, to be classified into a specific field, a person had

FIGURE 1.
Region of Residence of Engineers and U.S. Population 25 Years and Over: 1978



Source: Table 1 and Current Population Reports, Population Characteristics, Geographical Mobility: March 1975 to March 1978, Series P-20, No. 331.

FIGURE 2.
Fields of Science or Engineering (S/E) in the National Sample

Computer specialists
Engineers
Mathematical specialists
- Mathematicians
- Statisticians

Life scientists
- Agricultural scientists
- Biologists
- Medical scientists

Physical scientists
- Chemists
- Physicists and astronomers
- Other physical scientists

Environmental scientists
- Earth scientists
- Atmospheric scientists
- Oceanographers

Psychologists
Social scientists
- Economists
- Sociologists and anthropologists
- Other social scientists

[1] U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, Vol. 26, No. 1, January 1979.

[2] Data on the geographic distribution of the U.S. population 25 years old and over are found in: Current Population Reports, Series P-20, No. 331, *Geographical Mobility:* March 1975 to March 1978.

to have at least two of the following three characteristics: (1) employment in one of a set of specified occupations, (2) an academic degree among a set of specified academic disciplines, and (3) self-identification within a set of specified professions. Because of these criteria, it was possible for persons in each field to be distributed among a spectrum of occupations. Not surprisingly, a large proportion of the engineers employed in February 1978 were working in engineering occupations (about 80 percent). Specifically, about 20 percent worked as electrical and electronic engineers, 18 percent as mechanical engineers, and 12 percent as civil and architectural engineers; 9 percent were employed in "other engineering" occupations. Seventeen percent of the employed engineers worked as managers and administrators.

EDUCATION AND TRAINING (Table 2)

- As their highest academic degree, about 68 percent of the engineers held bachelor degrees, about 23 percent had master's degrees, and about 6 percent had doctorate degrees. About 2 percent of the engineers did not have an academic degree. According to the criteria developed by the National Science Foundation, engineering was the only field in the National Sample that could include persons without an academic degree.
- Engineers were more likely to have a bachelor's degree and less likely to have a doctorate degree than persons in the scientific fields, with the exception of the computer specialists, who were similar to engineers.
- Not suprisingly, 87 percent of the engineers majored for their highest degree in the academic field of engineering. Interestingly, about 3 percent reported business and commerce as the major field of study.
- Supplementary training programs (such as on-the-job and employer training programs) gave engineers the opportunity to maintain or improve their skills. About 48 percent of the engineers took advantage of these programs in 1977.[3]

PROFESSIONAL EXPERIENCE AND GROWTH OF THE FIELD (Table 3)

- Most of the engineers have been involved in professional work, though not necessarily as engineers, for a number of years. About 96 percent of the engineers had more than 5 years of professional experience, 85 percent had over 10 years, and 49 percent had more than 20 years. The median number of years of professional experience for persons in the field was 21.
- The figures in the lower percent distribution of table A shows the interfield mobility between 1976 and 1978 of persons in the National Sample. Among persons who were

[3]Note that the categories of supplemental training are not mutually exclusive: the same person may have received more than one kind.

Table A. Field of Science or Engineering in 1978, by Field of Science or Engineering in 1976

(Numbers in thousands)

Field of science or engineering in 1976	Total national sample in 1978	In field of science or engineering in 1978			Not in S/E field in 1978
		Total	Engineers	Other S/E field	
Total national sample in 1976.....	1,350	1,138	721	417	211
In S/E field in 1976.....	1,119	1,029	660	370	90
Engineers.....	707	660	649	11	47
Other S/E field.....	412	368	10	358	43
Not in S/E field in 1976.....	173	64	32	32	109
Did not report in 1976.....	57	45	30	15	12
PERCENT DISTRIBUTION					
Total national sample in 1976.....	100.0	100.0	100.0	100.0	100.0
In S/E field in 1976.....	82.9	90.4	91.5	88.7	42.7
Engineers.....	52.4	58.0	90.0	2.6	22.3
Other S/E field.....	30.5	32.3	1.4	85.9	20.4
Not in S/E field in 1976.....	12.8	5.6	4.4	7.7	51.7
Did not report in 1976.....	4.2	4.0	4.1	3.6	5.7
Total national sample in 1976.....	100.0	84.3	53.4	30.9	15.6
In S/E field in 1976.....	100.0	92.0	59.0	33.1	8.0
Engineers.....	100.0	93.4	91.8	1.6	6.6
Other S/E field.....	100.0	89.3	2.7	86.9	10.4
Not in S/E field in 1976.....	100.0	37.0	18.5	18.5	63.0
Did not report in 1976.....	100.0	78.9	52.6	26.3	21.1

Source: Table 3 and unpublished data from the 1978 National Sample of Scientists and Engineers.

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in the engineering field in 1976, about 92 percent were also engineers in 1978; about 7 percent were outside S/E fields altogether, and about 2 percent were in some other S/E field. The upper percent distribution of table A shows the engineering field in 1978 in terms of its 1976 components.

- About 33 percent of the engineers employed in February 1978 and February 1976 changed jobs[4] during the 2-year period; for about two-fifths (38 percent) of these job changers, the change in jobs involved a change in detailed occupations. Of engineers employed in February 1978 and January 1974, 49 percent changed jobs during the 4-year period; of these, 42 percent changed detailed occupations. Finally, of the engineers employed in February 1978 and January 1972, 60 percent changed jobs during the 6-year period; of these, 43 percent[5] changed detailed occupations. (figure 3).

Labor Force Participation (Table 4)

- In February 1978, 92 percent of the engineers were in the labor force. Of those not in the labor force, 94 percent were retired.

- The unemployment rate (the number unemployed as a percent of those in the labor force) for engineers was 1.0 percent (table 8). By comparison, the national unemployment rate of male professional, technical, and kindred workers 25 years old and over in February 1978 (not seasonally adjusted) was 1.5 percent.[6]

- Ninety-eight percent of employed engineers had full-time jobs. About 83 percent of the engineers who worked part time in February 1978 were not seeking full-time employment (table C). Of those employed full time, 96 percent held engineering or scientific positions.

- About 3.5 percent of the engineers experienced unemployment at one time or another in calendar year 1977. Engineers with unemployment spent a median of 12 weeks seeking employment in 1977. Approximately 23 percent of the engineers with unemployment sought work for 27 weeks or more in 1977.

- The majority of the employed engineers were concentrated in two industry groups in 1978: manufacturing

Table B. Employment Status of Engineers in February 1978

Employment status	Engineers	
	Number	Percent
Total in labor force in February 1978.....	663,317	100.0
Employed.....	656,897	99.0
Unemployed.....	6,420	1.0

Source: Table 4.

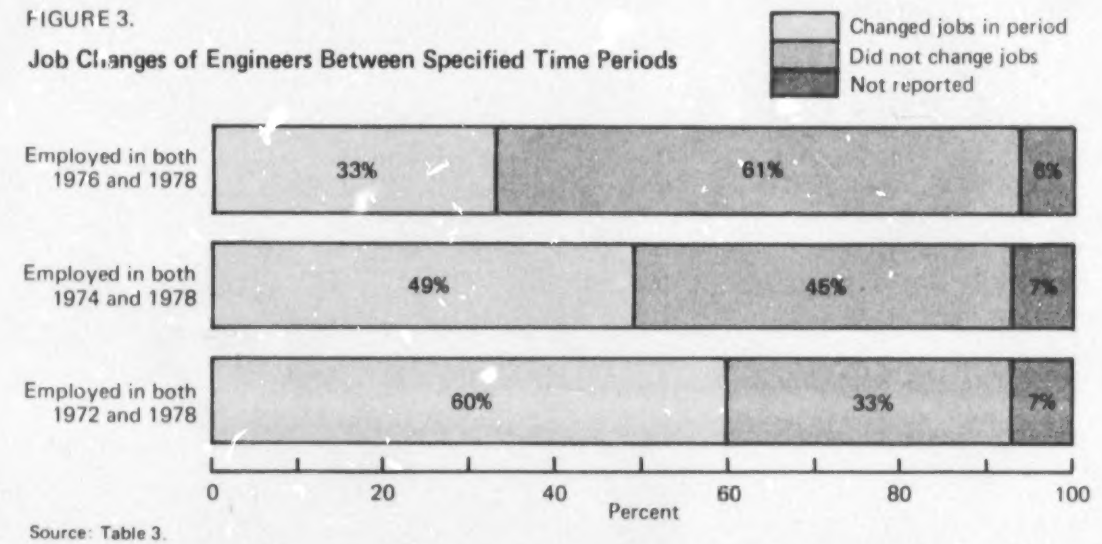
[4]That is, changed employers or remained with the same employer, but had a significant change in their duties, level of responsibility, or occupation.

[5]There is some evidence that the 42 percent who changed detailed occupations during the 4-year period is different from the 43 percent who changed detailed occupations during the 6-year period.

[6]U.S. Department of Labor, Bureau of Labor Statistics, unpublished Current Population Survey data.

FIGURE 3.

Job Changes of Engineers Between Specified Time Periods



Source: Table 3.

Table C. Full- and Part-time Work Status of Engineers in 1978 Employed in February 1978

Full- and part-time work status	Engineers	
	Number	Percent
Total employed in February 1978	656,897	100.0
Full time	645,162	98.2
Part time	10,840	1.7
Seeking full-time work	1,356	12.5
Not seeking full-time work	9,009	83.0
Not reported	475	4.4
Full or part time not reported	895	0.1

Source: Table 4.

(about 51 percent), with the largest proportion (12 percent) in the electronic machinery and computing equipment industry; and services, except education and health, (about 21 percent) with, not surprisingly, a heavy concentration in engineering and architectural services (about 15 percent).

- The 1978 survey asked persons to describe the type of organization of their principal employment or post-doctoral appointment. Among the engineers employed in February 1978, 76 percent specified their employer's organization as a (private) business or industry and 16 percent as "Federal, State, or local government."

- When asked to identify their primary work activity, 35 percent of the engineers employed in February 1978 specified management or administration, about 29 percent reported research and development, and about 17 percent indicated production and inspection.

- The engineers in the national Sample were asked to choose, from among a list of topics of critical national interest, the problem to which they devoted the most professional time. The largest proportions of engineers listed national defense (17 percent), energy and fuel (16 percent), and environmental protection and pollution control (12 percent). However, about 34 percent of the engineers either indicated that the inquiry was not applicable to them or did not report involvement in topics.

- The Federal government supported or sponsored at least some of the work of 41 percent of the engineers. The Department of Defense funded 22 percent, the Department of Transportation and NASA funded about 6 percent each, and the Department of Energy funded 5 percent.

INCOME (Table 5)

- The median basic annual salary rate of engineers employed full time in February 1978 was $27,275. Although not strictly comparable with these figures, the median earnings in 1977, as estimated from the CPS,[7] for male professional, technical, and kindred workers, 14 years old and over, who worked year round full time, was $18,224; the comparable figure for women was $11,995. Male year-round full-time workers 25 years old and over with 4 or more years of college (regardless of occupation) had mean earnings in 1977 of $21,441; those with 5 or more years of college had mean earnings of $25,782.[8]

- Results from the 1976 survey of the National Sample of Scientists and Engineers showed a median basic annual salary in February 1976 of engineers employed full time in February 1976 of $23,176. Thus, the median basic annual salary of full-time employed engineers rose by $4,099 over the 2-year period. However, when the 1976 and 1978 basic annual salaries are expressed in constant 1977 dollars, the increase is approximately $1,180[9] or an average of 2.? percent per year.

[7] U.S. Department of Commerce, Bureau of the Census, Current Population Reports, *Money Income in 1977 of Families and Persons in the United States*, Series P-60, No. 118.

[8] The CPS concept "earnings" includes more sources of remuneration than does the National Sample concept of "basic annual salary." There are also other differences between the National Sample's basic annual salary concept and the CPS earnings concept, including differences in reference periods and data collection procedures. Also, "medians" of salary distributions are calculated differently from "means" of earnings distributions; thus "median" data may not be entirely comparable with "mean" data. CPS figures for 1977 are cited because 1977 is the full year most nearly comparable with the reference year for the 1978 National Sample question on basic annual salary.

[9] The 1976-1978 comparisons in terms of constant 1977 dollars must be approached cautiously. Problems are introduced into the comparisons by, among other things, the way the basic annual salary data are defined and collected, the differences between the nonresponse adjustment procedures of the 1976 and 1978 surveys, and the difficulty of establishing appropriate time periods for the constant dollar computations.

Table 1. Occupation, Professional Identification, and Selected Characteristics of Engineers: 1978

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Occupation, professional identification, and selected characteristics	Engineers		Occupation, professional identification, and selected characteristics	Engineers	
	Number	Percent		Number	Percent
Total	721,158	100.0	OCCUPATION IN 1978		
Male	718,041	99.6			
Female	3,117	0.4	Total employed in February 1978	656,897	100.0
Under 30 years	6,367	0.9	Computer specialists	3,263	0.5
30 to 34 years	78,369	10.9	Computer systems analysts	1,062	0.2
35 to 39 years	115,409	16.0	Computer scientists	643	(Z)
40 to 44 years	114,702	15.9	Computer programmers	270	(Z)
45 to 49 years	111,327	15.4	Other computer fields	1,288	0.2
50 to 54 years	112,804	15.6			
55 to 59 years	83,567	11.6	Engineers	521,995	79.5
60 to 64 years	48,692	6.8	Aeronautical and astronautical	23,467	3.6
65 to 69 years	29,729	4.1	Agricultural	3,449	0.5
70 years and over	20,191	2.8	Chemical	31,019	4.7
Median age	47	(X)	Civil and architectural	80,482	12.3
			Electrical and electronic	133,286	20.3
RESIDENCE IN 1978			Industrial	23,217	3.5
			Mechanical	115,067	17.5
Total	721,158	100.0	Metallurgical and materials	14,846	2.3
			Mining, petroleum, and geological	10,061	1.5
United States	715,592	99.2	Nuclear	5,611	0.9
Northeast	186,495	25.9	Environmental and sanitary	11,572	1.8
New England	56,110	7.8	Operations research systems	10,817	1.6
Middle Atlantic	130,385	18.1	Other engineering fields	59,102	9.0
North Central	171,475	23.8			
East North Central	128,258	17.8	Mathematicians and statisticians	2,126	0.3
West North Central	43,217	6.0	Mathematicians	17	(Z)
South	189,797	26.3	Statisticians	47	(Z)
South Atlantic	95,988	13.3	Actuaries	55	(Z)
East South Central	29,526	4.1	Operations research	2,006	0.3
West South Central	64,276	8.9			
West	167,829	23.3	Life scientists	243	(Z)
Mountain	36,232	5.0	Agricultural scientists	78	(Z)
Pacific	131,598	18.2	Biological scientists	-	-
Outlying areas	215	(Z)	Biochemists	15	(Z)
Foreign countries	5,351	0.7	Biophysicists	-	-
Not reported	-	-	Medical scientists	133	(Z)
			Other life scientists	17	(Z)
RACE					
			Physical scientists	430	(Z)
Total	721,158	100.0	Chemists	110	(Z)
			Physicists and astronomers	108	(Z)
White	694,073	96.2	Other physical scientists	212	(Z)
Black	5,249	0.7			
American Indian	567	(Z)	Environmental scientists	123	(Z)
Chinese, Japanese, Korean	17,278	2.4	Earth scientists	109	(Z)
All other races	3,990	0.6	Atmospheric scientists	15	(Z)
			Oceanographers	-	-
HISPANIC HERITAGE					
			Psychologists	-	-
Total	721,158	100.0	Social scientists	135	(Z)
			Economists	123	(Z)
Hispanic	10,617	1.5	Sociologists and anthropologists	-	-
Not Hispanic	685,711	95.1	Other social scientists	12	(Z)
Not reported	24,830	3.4			

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Table 1. Occupation, Professional Identification, and Selected Characteristics of Engineers: 1978--Continued

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Occupation, professional identification, and selected characteristics	Engineers		Occupation, professional identification, and selected characteristics	Engineers	
	Number	Percent		Number	Percent
OCCUPATION IN 1978--Continued			PROFESSIONAL IDENTIFICATION IN 1978		
			Total	721,158	100.0
Health occupations	108	(Z)	Computer specialists	2,404	0.3
Physician or surgeon	-	-	Engineers	610,043	84.6
Dental technician	-	-	Mathematicians and statisticians	2,196	0.3
Medical technician	52	(Z)	Life scientists	170	(Z)
Other health occupations	55	(Z)	Physical scientists	1,431	0.2
			Environmental scientists	223	(Z)
			Psychologists	14	(Z)
Technicians and technologists, except medical	3,352	0.5	Social scientists	60	(Z)
Teachers[1]	698	0.1	Health occupations	200	(Z)
Administrators and managers	111,803	17.0	Technicians, except medical	1,009	0.1
Other occupations	11,172	1.7	Teachers	141	(Z)
Not reported	1,468	0.2	Administrators	87,833	12.2
			All other occupations	1,908	0.3

[1]College or university teachers of science or engineering are excluded from teachers and included in occupation corresponding to subject taught.

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Table 2. Selected Educational Characteristics of Engineers: 1978

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Selected educational characteristics	Engineers		Selected educational characteristics	Engineers	
	Number	Percent		Number	Percent
HIGHEST DEGREE HELD			MAJOR FIELD OF STUDY FOR HIGHEST DEGREE HELD--Continued		
Total	721,158	100.0			
With a degree	703,533	97.6	Earth, space, and marine sciences	2,564	0.4
Associate	10,816	1.5	Psychology	697	(Z)
Bachelor's	487,560	67.6	Economics	825	0.1
Master's	164,359	22.8	Sociology and anthropology	282	(Z)
Doctorate	39,606	5.5	Other social sciences	2,092	(Z)
Professional/medical	1,074	0.1	Business and commerce	19,832	2.8
Other	117	(Z)	All other fields	12,291	1.7
No degree	17,625	2.4	All fields below BA	11,233	1.6
Not reported	-	-	Field not reported	5,790	0.8
MAJOR FIELD OF STUDY FOR HIGHEST DEGREE HELD			SUPPLEMENTAL TRAINING IN 1977[1]		
Total	703,533	100.0	Total	721,158	100.0
Computer science and systems analysis	1,693	0.2	With supplemental training in 1977	345,070	47.8
Engineering	613,502	87.2	On-the-job training	175,239	24.3
Mathematical sciences	7,101	1.0	Military training applicable to civilian occupations	5,592	0.8
Agricultural sciences	1,534	0.2	Extension or correspondence courses	33,934	4.7
Biological sciences	1,076	0.2	Employer training programs	157,136	21.8
Medical sciences	850	0.1	Adult education center	41,589	5.8
Chemistry	7,907	1.1	Other training	70,802	9.8
Physics and astronomy	14,265	2.0	No supplemental training in 1977	303,943	42.1
			Not reported	72,145	10.0

[1] Sum of types of training may exceed total with training because of multiple response.

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Table 3. Years of Professional Experience, Field of Science or Engineering in 1976, and Job Mobility of Engineers: 1978

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Professional experience, field in 1976, and job mobility	Engineers	
	Number	Percent
YEARS OF PROFESSIONAL EXPERIENCE		
Total	721,158	100.0
With years of professional experience reported	701,008	97.2
Less than 1 year	2,035	0.3
1 to 5 years	5,801	0.8
6 to 10 years	78,138	10.8
11 to 15 years	121,261	16.8
16 to 20 years	142,387	19.7
21 to 25 years	106,737	14.8
26 to 30 years	130,696	18.1
31 to 35 years	43,418	6.0
36 to 40 years	46,337	6.4
41 years or more	24,200	3.4
Median years of professional experience	21	(X)
Years of professional experience not reported	20,149	2.8
FIELD OF SCIENCE OR ENGINEERING IN 1976		
Total	721,158	100.0
Computer specialists	3,698	0.5
Engineers	649,191	90.0
Mathematical specialists	830	0.1
Mathematicians	639	0.1
Statisticians	190	(Z)
Life scientists	473	0.1
Agricultural scientists	191	(Z)
Biologists	188	(Z)
Medical scientists	99	(Z)
Physical scientists	4,251	0.6
Chemists	1,923	0.3
Physicists and astronomers	1,635	0.2
Other physical scientists	693	0.1
Environmental scientists	863	0.1
Earth scientists	830	0.1
Atmospheric scientists	18	(Z)
Oceanographers	15	(Z)
Psychologists	36	(Z)
Social scientists	239	(Z)
Economists	87	(Z)
Sociologists and anthropologists	101	(Z)
Other social scientists	51	(Z)
Not in a field in 1976	32,027	4.4
Did not report in 1976	29,544	4.1
JOB MOBILITY		
Total employed in February 1978	656,897	100.0
Employed in February 1976	612,467	93.2
Job change since 1976	200,861	30.6
Occupation change	77,146	11.7
No occupation change	121,715	18.5
Occupation change not reported	2,001	0.3
Same job in 1976 and 1978	373,042	56.8
Not reported	38,564	5.9
Not employed or employment status not reported in February 1976	44,431	6.8
Employed in January 1974	621,710	94.6
Job change between 1974 and 1978	303,396	46.2
Occupation change	126,157	19.2
No occupation change	177,069	27.0
Occupation change not reported	169	(Z)
Same job in 1974 and 1978	277,468	42.2
Not reported	40,847	6.2
Not employed or employment status not reported in January 1974	35,188	5.4
Employed in 1972	637,726	97.1
Job change between 1972 and 1978	383,929	58.4
Occupation change	166,285	25.3
No occupation change	217,432	33.1
Occupation change not reported	213	(Z)
Same job in 1972 and 1978	211,940	32.3
Not reported	41,857	6.4
Not employed or employment status not reported in 1972	19,171	2.9

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Table 4. Employment Status and Selected Job-Related Characteristics of Engineers: 1978

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Employment status and selected job-related characteristics	Engineers	
	Number	Percent
EMPLOYMENT STATUS IN FEBRUARY 1978		
Total	721,158	100.0
In labor force	663,317	92.0
Employed	656,897	91.1
Full time	645,162	89.5
Part time	10,840	1.5
Seeking full-time work	1,356	0.2
Not seeking full-time work	9,009	1.2
Not reported	475	(Z)
Full or part time not reported	895	0.1
Unemployed	6,420	0.9
Not in labor force	57,840	8.0
Retired	54,164	7.5
Student	541	(Z)
Family responsibilities	587	(Z)
Could not find work	607	(Z)
Other	1,941	0.3
FULL-TIME EMPLOYMENT IN SCIENCE OR ENGINEERING IN 1978		
Total employed full time in February 1978	645,162	100.0
In science or engineering	619,385	96.0
Not in science or engineering	24,363	3.8
Preferred nonscience or nonengineering	3,524	0.5
Promoted out of science or engineering	10,678	1.7
Pay better in nonscience or nonengineering	1,782	0.3
Locational preference	1,304	0.2
Science or engineering position not available	1,837	0.3
Other reason	4,496	0.7
Reason not reported	743	0.1
Not reported	1,414	0.2
UNEMPLOYMENT IN CALENDAR YEAR 1977		
Total	721,158	100.0
Unemployed in calendar year 1977	25,099	3.5
1 to 4 weeks	5,363	0.7
5 to 10 weeks	5,475	0.8
11 to 14 weeks	2,884	0.4
15 to 26 weeks	3,819	0.5
27 weeks or more	5,693	0.8
Median weeks of unemployment	12	(X)
Weeks of unemployment not reported	1,865	0.3
Not unemployed in calendar year 1977	678,793	94.1
Not reported	17,266	2.4
INDUSTRY IN 1978		
Total employed in 1978	656,897	100.0
Agriculture, forestry, and fisheries	3,402	0.5
Mining and petroleum extraction	11,053	1.7
Construction	24,309	3.7
INDUSTRY IN 1978--Continued		
Manufacturing	334,052	50.9
Primary metal industries	14,749	2.2
Fabricated metal industries	18,800	2.9
Machinery, except electrical	26,632	4.1
Electrical machinery, equipment, and supplies	25,061	3.8
Electronic machinery and computing equipment	78,851	12.0
Aircraft and aircraft parts	41,130	6.3
Motor vehicles and motor vehicle equipment	22,714	3.5
Ordnance	26,468	4.0
Chemicals and allied products	33,232	5.1
Petroleum refining and related industries	15,150	2.3
Other manufacturing	31,264	4.8
Transportation, communications, and other public utilities	34,118	5.2
Wholesale and retail trade	5,639	0.9
Finance, insurance, and real estate	2,961	0.5
Educational institutions	21,720	3.3
College or university	17,319	2.6
Other	4,401	0.7
Health services	1,940	0.3
Services, except education and health	137,167	20.9
Engineering and architectural services	96,654	14.7
Research institutions	29,209	4.4
Other	11,304	1.7
Public administration	45,093	6.9
Federal	18,204	2.8
Other	25,250	3.8
Military	1,638	0.2
Other industries	31,061	4.7
Not reported	4,384	0.7
TYPE OF EMPLOYER IN 1978		
Total employed in February 1978	656,897	100.0
Business or industry	497,863	75.8
Educational institutions	29,869	4.5
Junior or 2-year college, technical institute	3,553	0.5
Medical school	363	(Z)
4-year college or university, except medical school	25,290	3.8
Elementary or secondary school system	663	0.1
Hospital or clinic	982	0.1
Nonprofit organization	9,464	1.4
U.S. military service/commissioned groups	2,428	0.4
Government	105,877	16.1
Federal	60,615	9.2
State	21,168	3.2
Local or other	24,094	3.7
International agency	504	(Z)
Other	1,042	0.2
Not reported	8,870	1.4

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Table 4. Employment Status and Selected Job-Related Characteristics of Engineers: 1978—Continued

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Employment status and selected job-related characteristics	Engineers		Employment status and selected job-related characteristics	Engineers	
	Number	Percent		Number	Percent
PRIMARY WORK ACTIVITY IN 1978			NATIONAL INTEREST TOPICS[1]		
Total employed in February 1978..	656,897	100.0	Crime prevention and control.....	1,878	0.3
			Food production and technology.....	11,800	1.6
Research and development.....	190,027	28.9	Energy and fuel.....	114,972	15.9
Basic research.....	3,401	0.5	Other mineral resources.....	6,223	0.9
Applied research.....	22,233	3.4	Community development and services....	15,066	2.1
Development.....	93,267	14.2	Housing.....	14,773	2.0
Design.....	71,126	10.8	Other.....	46,120	6.4
Management or administration.....	229,350	34.9	Not applicable.....	180,104	25.0
Research and development.....	81,763	12.4	Not reported.....	62,634	8.7
Other.....	147,587	22.5			
Teaching and training.....	15,756	2.4	FEDERAL SUPPORT IN 1978[2]		
Production and inspection.....	112,176	17.1			
Quality control.....	24,565	3.7	Total employed in February 1978.	656,897	100.0
Operations.....	69,758	10.6			
Distribution-sales.....	17,853	2.7	With Federal support.....	270,161	41.1
			Department of Agriculture.....	7,332	1.1
Consulting.....	37,462	5.7	Department of Commerce.....	6,965	1.1
Clinical diagnosis.....	703	0.1	Department of Defense.....	146,332	22.3
Consulting.....	36,760	5.6	Department of Energy.....	34,893	5.3
Report writing, statistical work, and computer applications.....	35,546	5.4	Department of Health, Education, and Welfare.....	7,426	1.1
Report writing.....	20,170	3.1	Department of Housing and Urban Development.....	11,865	1.8
Statistical work.....	6,507	1.0	Department of the Interior.....	7,483	1.1
Computer applications.....	8,869	1.4	Department of Justice.....	555	(Z)
Other activities.....	27,403	4.2	Department of Labor.....	698	0.1
Not reported.....	9,178	1.4			
			Department of Transportation.....	38,491	5.9
NATIONAL INTEREST TOPICS[1]			Agency for International Development	2,143	0.3
Total.....	721,158	100.0	Environmental Protection Agency.....	23,112	3.5
			NASA.....	42,120	6.4
Health.....	11,742	1.6	National Science Foundation.....	6,984	1.1
Education.....	17,349	2.4	Nuclear Regulatory Commission.....	5,758	0.9
Teaching.....	14,432	2.0	Other department or agency.....	14,014	2.1
Other.....	2,917	0.4	Agency not known.....	4,124	0.6
Environmental protection, pollution control.....	84,024	11.7	Agency not reported.....	2,257	0.3
Space.....	29,470	4.1	No Federal support.....	357,701	54.5
National defense.....	125,001	17.3	Federal support not known.....	19,708	3.0
			Not reported.....	9,328	1.4

[1]Area of national concern in which persons devoted the largest proportion of professional time.
[2]Sum of individual agencies support may exceed total with Federal support because of multiple response.

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Table 5. Basic Annual Salary Rate of Full-Time Employed Engineers: 1978

(Detail may not add to total because of rounding. For meaning of symbols, see text)

Salary	Engineers		Salary	Engineers	
	Number	Percent		Number	Percent
Total employed full time in February 1978	645,162	100.0	With salary reported[1]--Continued		
			$20,000 to $24,999	150,202	23.3
			$25,000 to $29,999	162,712	25.2
With salary reported[1]	603,181	93.5	$30,000 to $39,999	172,201	26.7
Less than $8,000	929	0.1	$40,000 to $49,999	37,829	5.9
$8,000 to $9,999	1,137	0.2	$50,000 and over	22,107	3.4
$10,000 to $14,999	9,207	1.4	Median salary (dollars)	$27,275	(X)
$15,000 to $19,999	46,855	7.3	Salary not reported	41,981	6.5

[1]Refers to salary for job held during the week of February 12-18, 1978.

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Appendix A. Definitions and Explanations

The 1978 National Survey of Natural and Social Scientists and Engineers was the fourth survey based on the 1970 population of scientists and engineers. It was conducted by the Bureau of the Census for the National Science Foundation. The first survey, the 1972 Professional, Technical, and Scientific Manpower Survey,[1] was conducted among a nationwide sample of approximately 150,000 persons who were recorded in the 1970 Census of Population as being in the experienced civilian labor force in 1 of 63 engineering, scientific, or related occupations. The survey also included a small sample of persons who had completed 4 or more years of college, but were not in any of the specified occupations. Based on responses in the 1972 survey and on criteria established by the National Science Foundation, approximately 50,000 persons from the 1972 survey sample (excluding the small sample of college graduates) were chosen as the sample for the series of longitudinal surveys known as the National Sample of Scientists and Engineers. The 1978 National Survey of Natural and Social Scientists and Engineers was the third survey in this longitudinal series; it was preceded by surveys in 1976 and 1974.[2]

Questionnaires for the 1978 survey were mailed in February 1978. After all data collection activities, 81 percent of the sample (approximately 40,800 persons) completed their questionnaires. The 19 percent who did not complete their questionnaires included persons who refused to participate, the deceased, and persons who returned questionnaires with insufficient information to permit processing. For an analysis of response, see appendix E.

The estimates derived for this survey were prepared by using a ratio estimation procedure and an adjustment for nonresponse in 1978. For each sample case for which a completed questionnaire was obtained, the information from the 1978 survey was matched with the 1972 survey data and the 1970 census data for the same person. Weights applied to samples cases in the 1972 survey were then used to weight the resultant matched data file. The weighting procedure for the 1972 survey involved first the preparation of a preliminary estimate by weighting the results for each sample person by the reciprocal of the probability of selection. As a second step, these weights were adjusted by applying a factor for certain age-sex-race cells within each occupation category. Within each of the cells, the factor was computed as the ratio of the 1970 census count to the preliminary estimate. The final 1972 weight was this factor multiplied by the inverse of the probability of selection for each person. To the extent that the data being tabulated and the estimated count of persons in the cells are positively correlated, the ratio estimate procedure will improve the reliability of the estimate. A discussion of the reliability of the estimates, including a description of the standard errors of totals and percentages, is presented in appendix B.

A nonresponse adjustment was done in 1978 to reduce the bias in the survey estimates due to the high nonresponse rate in 1978. This adjustment was done separately for inscope[3] and out-of-scope[4] persons, and included an adjustment for the mortality in the longitudinal sample from 1972 to 1978. The first step in the nonresponse adjustment was to adjust the nonrespondents for mortality from 1972 to 1978 by means of mortality tables for age-race-sex groups. The second step was to determine the estimated proportion of nonrespondents that were in-scope and out-of-scope. To estimate these proportions, an intensive follow-up was conducted to obtain interviews for a subsample of the 1978 nonrespondents. This follow-up showed that approximately 80 percent of the nonrespondents were in-scope and the remaining 20 percent were out-of-scope. The final step was to determine a nonresponse adjustment factor for different age-race-sex cells. Within each of the cells, the factor was computed as the ratio of the weighted count, using the 1972 weights, of the estimated total (i.e., respondent and nonrespondent) in-scope or out-of-scope persons, divided by the weighted count of the respondent in-scope or out-of-scope persons.

The final weight for the 1978 survey was the product of the 1972 weight and the appropriate 1978 nonresponse adjustment factor.

The definitions for many of the characteristics shown in this report are self-explanatory or can best be understood by referring to the appropriate 1978 questionnaire items or reference lists (appendixes C and D). An explanation of the other subjects is provided below.

Age in 1978. The reference period for age in 1978 was April 1978. The age classification is based on the age of the person at his or her last birthday. The median age is that age that

[1] For a description of the 1972 survey and related matters, see U.S. Bureau of the Census, *Characteristics of Persons in Engineering and Scientific Occupations: 1972*, Technical Paper No. 33, U.S. Government Printing Office, Washington, D.C., 1974.

[2] Results from the 1974 survey were published in U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 53, *Selected Characteristics of Persons in Fields of Science or Engineering: 1974*, U.S. Government Printing Office, Washington, D.C., 1975; results from the 1976 survey were published in U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 76, *Selected Characteristics of Persons in Fields of Science or Engineering: 1976*, U.S. Government Printing Office, Washington, D.C., 1978.

[3] "In-scope" means "in a field of science or engineering."

[4] "Out-of-scope" refers to the category "not in a field of science or engineering."

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divides the distribution into two equal parts, one-half being older than the median age and one-half younger. Median ages were divided from an estimation process that distributed the subject populations into 5-year age groups.

Race. The data on race are based on responses in the 1970 Census of Population. The "other races" category includes all races not included in the specific categories listed.

Divisions of the United States. The divisions of the United States comprise the following States:

New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

Middle Atlantic: New York, New Jersey, Pennsylvania

East North Central: Illinois, Indiana, Michigan, Ohio, Wisconsin.

West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.

South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia.

East South Central: Alabama, Kentucky, Mississippi, Tennessee.

West South Central: Arkansas, Louisiana, Oklahoma, Texas.

Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming.

Pacific: Alaska, California, Hawaii, Oregon, Washington.

Outlying areas of the United States include Puerto Rico, Guam, Virgin Islands, American Samoa, and Canal Zone.

Fields of science and engineering. Science or engineering (S/E) fields are categories established by the survey sponsor, the National Science Foundation, to identify persons who could be classified as engineers or scientists under most definitions. In general, to be classified into one of the fields, a person had to have at least two of the following three characteristics: (1) employment in the field, (2) attainment of a specified educational level in an academic discipline related to the field, or (3) self-identification, based upon total education and experience, as being in the field. More detailed information on the criteria for membership in a scientific and technical field is given in U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 76, *Selected Characteristics of Persons in Fields of Science or Engineering: 1976,* U.S. Government Printing Office, Washington, D.C., 1978.

Highest degree held. Highest degree held in 1978 refers to the highest academic degree awarded to the respondent in 1978 or earlier. Data on highest degree held were derived as follows: The level and the year of award of the highest degree received by the respondent between January 1972 and 1978 surveys (this degree will be referred to as degree "A") were compared with the level and year of award, determined from the 1976, 1974, and 1972 surveys, of the previously-designated highest degree held by the respondent (this is referred to as degree "B"). If degree A was at the same level or at a higher level than degree B, and if its date of award was later than that of degree B, degree A was designated as the highest degree held in 1978; otherwise, degree B was designated as the highest degree held in 1978.

The "other degree" category includes persons whose highest academic degree was one of the following: RN, LLB, MD, and academic degrees other than those shown in the tables.

Major field of study for highest degree held. The data on major field of study refer to the major subject associated with the highest degree held in 1978 determined by the method described above. For persons who received their highest degree held in 1978 after January 1972, the data are derived from question 3 of the 1978 questionnaire (see appendix C), or question 1, part b of the 1976 questionnaire or from question 2, part b5 of the 1974 questionnaire. For persons who received their highest degree in 1971 or earlier, the data on major subject are based on the 1972 survey.

Employment status. Employed persons are those who reported that they were employed, either full time or part time, on vacation, or otherwise temporarily absent from a job for health or personal reasons during the reference week (February 12-18, 1978). The unemployed are persons who marked the "unemployed and seeking work" category (box 3) of item 5a of the 1978 questionnaire (see appendix C), or who indicated in item 7 that they were on layoff from a job. All other persons were classified as "not in the labor force."

Unemployment in 1977. The data on unemployment in 1977 relate to the occurrence of unemployment during the entire calendar year rather than just during a reference week. Medians are based on the intervals shown in the tables.

Primary work activity in 1978. The data on primary work activity in 1978 were derived, in general, from answers to question 11b of the 1978 questionnaire. In certain instances of nonresponse to question 11b, however, the data were derived from an imputation procedure that used responses to question 11a.

Type of employer. The data on type of employer in 1978 are based entirely on responses to question 12 of the 1978 questionnaire.

Basic annual salary rate. The statistics on salary refer to the basic annual salary associated with the job held in February 1978. The figures relate to salary before deductions for income tax, Social Security, retirement, etc., but do not include bonuses, overtime pay, or earnings from secondary

jobs. For employees of educational institutions whose salary was for 9 or 10 months, the salary rate was adjusted to a 12-month basis. Median salaries were derived by an estimation process that distributed the subject population into $1,000 intervals.

Job and occupational mobility in 1976 and 1978. The data on mobility between 1976 and 1978 were derived from answers on both the 1976 and 1978 questionnaires. Persons were classified as with a "job change between 1976 and 1978" if they were employed in both 1976 and 1978 and reported in the 1978 survey that their current job began in 1976 or later. Persons were classified as "same job in 1976 and 1978" if the beginning date of their most recent job was in 1975 or earlier, and as "not reported" if they did not report the beginning date of the most recent job. For persons with a job change, the detailed occupation of the 1978 job was compared with that of the 1976 job, and persons were classified as with the same or a different occupation or as "occupation change not reported."

Job and occupational mobility in 1974 and 1978 and in 1972 and 1978. The data on mobility between 1974 and 1978 and between 1972 and 1978 were derived from answers on the 1974 and 1978 questionnaires and 1972 and 1978 questionnaires, respectively. The procedure was analogous to that described for the data on job and occupational mobility in 1976 and 1978.

Years of professional experience. Median years of professional experience are based on 1-year intervals.

Symbols. A dash (--) represents zero, and "X" means "not applicable." The symbol "Z" means less than 0.05 percent. The symbol "*" means based on fewer than 20 sample cases. For the characteristic "Unemployment in Calendar Year 1977," the symbol "27+" means that the median fell in the category "27 weeks or more."

Appendix B. Reliability of the Estimates and Standard Errors of Totals and Percentages

There are two types of possible errors associated with estimates based on data from a sample survey—sampling and nonsampling. The following is a description of the sampling and nonsampling errors associated with the 1978 Survey of Scientists and Engineers.

SAMPLING ERRORS

The particular sample used for this survey is one of a large number of possible samples of the same size that could have been selected using the same sample design. Even if the same schedules and instructions were used, estimates from each of the different samples would differ from each other. The deviation of a sample estimate from the average of all possible samples is defined as the sampling error. The standard error of a survey estimate attempts to provide a measure of this variation among the estimates from the possible samples, and thus, is a measure of the precision with which an estimate from the sample approximates the average result of all possible samples.

As calculated for this survey, the standard error also partially measures the variation in the estimates due to response errors (nonsampling errors), but it does not measure, as such, any systematic biases in the data. Therefore, the accuracy of the estimates depends on both the sampling and nonsampling errors not measured by the standard error.

The figures presented in tables B-1 and B-2 are approximations to the standard errors of the various estimates for this survey. A number of approximations and generalizations have been used so that the standard errors would be applicable to a wide variety of characteristics and still be prepared at a moderate cost. Thus, the standard errors in the following tables provide an indication of the order of magnitude, rather than precise measurements of the standard errors.

Standard errors on totals. Table B-1 presents the standard errors applicable to estimated totals for characteristics of engineers. Linear interpolation can be used to determine standard errors for estimated totals not specifically shown in table B-1. In addition, standard errors for estimated numbers not shown in these tables may also be computed directly from the following standard error formula:

$$\text{standard error of } x = \sqrt{ax^2 + bx}$$

The "a" and "b" parameters are:

Field	"a" parameter	"b" parameter
Engineers total	−.0000152	53.3

For example, there are an estimated 54,164 engineers, total, who were retired in 1978. The above table shows that a = −.0000152 and b 5 53.3 for engineers, total. Thus, the estimated standard error of 54,164 is

$$\sqrt{(-.0000152)(54,164)^2 + (53.3)(54,464)} = 1,686$$

Standard errors on percentages. The reliability of an estimated percentage, computed by using sample data for both the numerator and the denominator, depends upon both the size of the percentage and the size of the total upon which the percentage is based. Estimated percentages are relatively more reliable than the corresponding estimates of the numerators of the percentage, particularly if the percentages are 50 percent or more.

Table B-2 presents the standard errors of estimated percentages for engineers. Two-way linear interpolation can be used to determine standard errors for estimated percentages not specifically shown in table B-2. In addition, the standard errors for percentages not shown in these tables can also be computed directly from the following formula:[1]

$$\text{standard error of the percentage } p \text{ on a base of } y = \sqrt{(p)\,(100-p)\frac{b}{y}}$$

For example, an estimated 1.5 percent of the 721,158 engineers worked part-time in 1978. The above table shows that b 5 53.3 for engineers. Thus, the standard error for the 1.5 percent on a base of 721,158 is

$$\sqrt{\frac{(1.5)\,(100 - 1.5)\,(53.3)}{721,158}} = .10 \text{ percent}$$

Standard error intervals. The sample estimate and its estimated standard error enable one to construct interval estimates that include the average result of all possible samples with a known probability. For example, if all possible samples were selected, each of these surveyed under identical conditions and an estimate and its estimated standard error were calculated from each sample, then:

1. Approximately 68 percent of the intervals from one standard error below the estimate to one standard error above the estimate would include the average result of all possible samples.

2. Approximately 90 percent of the intervals from 1.6 standard errors below the estimate to 1.6 standard errors above the estimate would include the average result of all possible samples.

3. Approximately 95 percent of the intervals from two standard errors below the estimate to two standard errors above the estimate would include the average result of all possible samples.

[1]The tables for the standard errors of percentages for most scientific and engineering fields (SEF's) were combined. The tables of standard errors given for such collapsed groups are always conservative, i.e., the table for the SEF with the largest standard errors was chosen to represent all the SEF's in the group. Because of this, the standard errors calculated directly from the formula may differ slightly from those found in the tables.

Table B-1. Standard Errors of Totals

(68 chances out of 100)

Size of estimate	Engineers
100	70
200	100
500	160
700	190
1,000	230
2,500	370
5,000	520
10,000	730
25,000	1,150
50,000	1,620
75,000	1,980
100,000	2,280
150,000	2,770
200,000	3,170
250,000	3,520
300,000	3,830
400,000	4,350
500,000	4,780
600,000	5,150
700,000	5,470
800,000	5,470

The average result of all possible samples either is or is not contained in any particular computed interval. However, for a particular sample one can say with specified confidence that the average result of all possible samples is included within the constructed interval.

Standard errors may also be used to perform hypothesis testing, a procedure for distinquishing between population parameters using sample estimates. The most common types of hypotheses appearing in this report are: 1) The population parameters are identical, versus 2) they are different. An example of this would be comparing the mean annual income of men versus the mean annual income of women. Tests may be performed at various levels of significance, where a level of significance is the probability of concluding that the parameters are different when, in fact, they are identical.

All statements of comparison in the text have passed a hypothesis test at the 0.10 level of significance or better, and most have passed a hypothesis test at the 0.05 level of significance or better. This means that, for most differences cited in the text, the estimated difference between parameters is greater than twice the standard error of the difference. For the other difference mentioned, the estimated difference

Table B-2. Standard Errors of Percentages for Engineers

(68 chances out of 100)

Base of percentage	1 or 99	2 or 98	5 or 95	10 or 90	15 or 85	25 or 75	50
100	7.5	10.6	16.5	22.7	27.1	32.8	37.9
200	5.3	7.5	11.7	16.1	19.1	23.2	26.8
500	3.4	4.7	7.4	10.2	12.1	14.7	16.9
700	2.9	4.0	6.2	8.6	10.2	12.4	14.3
1,000	2.4	3.4	5.2	7.2	8.6	10.4	12.0
2,500	1.5	2.1	3.3	4.5	5.4	6.6	7.6
5,000	1.1	1.5	2.3	3.2	3.8	4.6	5.4
10,000	0.8	1.1	1.7	2.3	2.7	3.3	3.8
25,000	0.5	0.7	1.0	1.4	1.7	2.1	2.4
50,000	0.3	0.5	0.7	1.0	1.2	1.5	1.7
75,000	0.3	0.4	0.6	0.8	1.0	1.2	1.4
100,000	0.2	0.3	0.5	0.7	0.9	1.0	1.2
150,000	0.2	0.3	0.4	0.6	0.7	0.8	1.0
200,000	0.2	0.2	0.4	0.5	0.6	0.7	0.8
250,000	0.2	0.2	0.3	0.5	0.5	0.7	0.8
300,000	0.14	0.2	0.3	0.4	0.5	0.6	0.7
400,000	0.12	0.2	0.3	0.4	0.4	0.5	0.6
500,000	0.11	0.2	0.2	0.3	0.4	0.5	0.5
600,000	0.10	0.14	0.2	0.3	0.3	0.4	0.5
700,000	0.09	0.13	0.2	0.3	0.3	0.4	0.5
800,000	0.08	0.12	0.2	0.3	0.3	0.4	0.4

between parameters is between 1.6 and 2.0 times the standard error of the difference. When this is the case, the statement of comparison will be qualified in some way; e.g., by use of the phrase "some evidence."

For example, of the 721,158 engineers, in 1978, 22.8 percent have the master's degree as the highest degree held in 1978. The standard error of this percent as computed from table B-2 is 0.4 percentage points. Based on these data, we may conclude that the percentage of engineers with the master's degree as the highest degree held in 1978 lies between 22.0 percent and 23.6 percent with 95 percent confidence, i.e., within 2 standard errors.

Standard errors of differences between estimates. The figures in these tables are not directly applicable to standard errors of differences between two sample estimates. The standard error of the estimated difference between two figures may be approximated by the square root of the sum of the squares of the standard error of each estimate. This approximation will yield an exact result when the two characteristics are uncorrelated. If the two characteristics are positively (negatively) correlated, the approximation will overestimate (underestimate) the standard error of the difference. For a difference between two sample estimates, one of which represents a subclass of the other, the table can be used with the difference considered as the sample estimate.

For example, of the 721,158 engineers in 1978, 67.6 percent have the bachelor's as the highest degree held in 1978. The standard error of this percent as computed from table B-2 is 0.4 percentage points. The standard error of the difference between the percentage of those with bachelor's degrees and the percentage of those with master's degree (i.e. 67.6 − 22.8 = 44.8 percent) is then approximately

$$\sqrt{(0.4)^2 + (0.4)^2} = 0.6 \text{ percentage points}$$

Based on these data, we may conclude with 95 percent confidence that the average estimate of the difference of the percentages derived from all possible sample lies within the interval 43.6 percentage points to 46.0 percentage points.

Standard errors of medians. The figures in these tables are not directly applicable to standard errors of estimated medians. The sampling variability of an estimated median depends upon the size of the base as well as on the distribution from which the median is determined. An approximate method for measuring the reliability of a median is to determine an interval about the estimated median, such that there is a stated degree of confidence that the median based on all possible samples lies with the interval. The following procedure may be used to estimate confidence limits of a median based on sample data:

1. Determine the standard error of a 50-percent characteristic from the appropriate standard error table (table B-2) using the appropriate base.
2. Add this standard error to 50 percent to obtain an upper boundary percentage and subtract this standard error from 50 percent to obtain a lower boundary percentage.
3. Using the cumulative distribution from which the median is derived, read off the numbers corresponding to the boundary percentages. The interval between these two numbers (i.e., the confidence limits) will be the 68-percent confidence interval. A 95-percent confidence interval may be determined by finding the values corresponding to 50 percent plus or minus twice the standard error in step 1.

For example, the data for 1978 indicate that the estimate of the median age for engineers is 47.0 years. The distribution of engineers by age is shown in the table below:

Age (years)	Percentage	Cumulative distribution
Under 30	0.9	0.9
30 to 34	10.9	11.8
35 to 39	16.0	27.8
40 to 44	15.9	43.7
45 to 49	15.4	59.1
50 to 54	15.6	74.7
55 to 59	11.6	86.3
60 to 64	6.8	93.1
65 to 69	4.1	97.2
70 and over	2.8	100.0

From standard error table B-2, the standard error of a 50-percent characteristic with a base of 721,158 is 0.5 percentage points. From the table of cumulative age distribution, the percentage point that corresponds to 45 years is 43.7 percent and to 50 years is 59.1 percent. The lower confidence limit corresponding to 49.5 percent (50 percent minus 0.5 percent) is found by linear interpolation between 45 years and 50 years to be 46.9 years, i.e.,

$$45 + (50 - 45)\frac{49.5 - 43.7}{59.1 - 43.7} = 46.9$$

Similarly, the upper confidence limit corresponding to 50.5 percent (50 percent plus 0.5 percent) is found to be 47.1 years:

$$45 + (50 - 45)\left(\frac{50.5 - 43.7)}{59.1 \quad 43.7}\right. = 47.2$$

Consequently the 68-percent confidence interval, as shown by the data, is from 46.9 years to 47.2 years. Likewise, we could conclude that the 95-percent confidence interval is from 46.7 years (the distribution point corresponding to 49.0 percent) to 47.4 years (corresponding to 51.0 percent).

NONSAMPLING ERRORS

In general, nonsampling errors can be attributed to many sources: Inability to obtain information about all cases; definitional difficulties; differences in the interpretation of questions; inability or unwillingness of the respondents to provide correct information; mistakes in recording or coding the data; and other errors of collection, response, processing, coverage, and estimation for missing data. As the above list indicates,

nonsampling errors are not unique to sample surveys, since they can, and do, occur in complete censuses as well.

The primary source of nonsampling error in the 1978 National Sample survey is probably the high nonresponse rate. An adjustment in the estimation procedure for the 23 percent noninterview rate in the 1972 survey and the additional 19 percent nonresponse rate in 1978 was made, but there still remains some unknown bias in the estimates due to differences in the characteristics of those who were interviewed in 1978 and those who were not.

It should also be pointed out that estimates for this survey do not represent those who have entered the labor force in scientific and engineering fields since 1970. In particular, this survey does not include the large numbers of graduates produced since 1970. This causes significant biases for such items as the relative distributions of sex, age, and race and the unemployment figures if the results are assumed to be indicative of the current scientific and engineering fields including new entrants since 1970.

Appendix C. Questionnaire and Reference Lists

O.M.B. No. 99-S77003; Approval Expires December 31, 1978

FORM PMS-26D (9-26-77)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

1978 NATIONAL SURVEY OF NATURAL AND SOCIAL SCIENTISTS AND ENGINEERS

NOTICE – Your report to the Census Bureau is confidential. It may be seen only by sworn Census employees and may be used only for statistical purposes.

Please read instructions carefully before answering questions.

Answer as accurately as you can by printing your reply clearly or by entering an "X" in the box next to the appropriate reply.

When the instructions for a question direct you to enter a code and description from a list, please refer to the reference list attached to this questionnaire.

PLEASE COMPLETE AND RETURN TO: Bureau of the Census, 1201 East Tenth Street, Jeffersonville, Indiana 47132

A. Do you currently live in the State (or foreign country) printed in the above mailing label?

1 ☐ Yes, same State (or foreign country)

2 ☐ No, different State (or foreign country) – *Please enter your current State (or foreign country) of residence* _____ ☐☐

FROM THE DIRECTOR
BUREAU OF THE CENSUS

This is the final questionnaire for the series of surveys known as the National Sample of Scientists and Engineers. The National Science Foundation, the project sponsor, and the Bureau of the Census wish to thank you for your invaluable contribution to this program. Each of the biennial surveys has given policymakers and planners an increasingly clearer view of the dynamics of the educational system and the job market for one of the Nation's central resources—highly trained persons. The goal of this final survey is to complete the picture for the decade of the 1970's.

Thus, we are asking you to provide one final report on your employment and related topics. The quesionnnaire is much shorter than previous ones. Please note that the sample includes many kinds of highly trained persons in addition to scientists and engineers. For the survey to be successful and yield truly representative information, it is important that each person fill out and return the questionnaire.

Please complete the questions which follow on pages 2 through 4 and return your questionnaire in the enclosed preaddressed envelope. For some questions you are instructed to enter a code and description from Reference List A, B, or C. These lists are attached to the questionnaire.

This information is being collected under the authority of the National Science Foundation Act of 1950, as amended. The information you provide is confidential and may be seen only by sworn employees of the Bureau of the Census. The information cannot be used for anything but statistical purposes and cannot be given to any other Government agency, private concern, or individual. The data will be released only in the form of statistical summaries from which it will be impossible to identify information about any particular person. Your response is entirely voluntary, and your failure to provide some or all of the requested information will in no way adversely affect you.

Thank you for your cooperation.

Sincerely,

Manuel D. Plotkin

MANUEL D. PLOTKIN

Enclosure

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PART I – EDUCATION AND TRAINING

1. Since January 1972 have you attended any college, university, or other post high school institution?

1 ☐ Yes – *Continue with question 2a*
2 ☐ No – *Skip to question 4*

2a. What is the highest degree you have RECEIVED since January 1972?

Mark only one box

1 ☐ Associate
2 ☐ Registered Nurse (R.N.)
3 ☐ Bachelor's
4 ☐ Master's
5 ☐ First Professional Non-Medical (J.D., LL.B., Th.B.)
6 ☐ First Professional Medical (D.D.M., D.D.S., D.O., D.V.M., M.D.)
7 ☐ Doctorate
8 ☐ Other – *Specify* _____
9 ☐ None – *Skip to question 4*

b. When was this degree awarded?

If you received more than one degree at the same level (e.g., two master's degrees), enter the year of award of the most recent one.

19 ____

3. What was the major field of study of the degree you described in question 2?

Enter code and description from Reference List A.

Code ☐☐☐ Description from Reference List A _____

4. Aside from formal education, which of the following types of training did you receive in 1976 or 1977?

Mark the appropriate year for each type of training you have received.

	a. 1976	b. 1977
(1) On-the-job training	1 ☐	1 ☐
(2) Military training applicable to civilian occupations	2 ☐	2 ☐
(3) Extension or correspondence courses	3 ☐	3 ☐
(4) Courses at employer's training facility	4 ☐	4 ☐
(5) Courses at adult education center	5 ☐	5 ☐
(6) Other training	6 ☐	6 ☐
(7) None	7 ☐	7 ☐

PART II – EMPLOYMENT STATUS

5a. What was your employment status during the week of February 12–18, 1978?

1 ☐ Employed full time (including self-employed full time) – *Skip to 6a*
2 ☐ Employed part time (including self-employed part time) – *Answer 5b*
3 ☐ Unemployed and seeking work – *Go to Part III*
4 ☐ Not employed and not seeking work – *Skip to 7*

b. If you worked part time, were you seeking full-time work?

1 ☐ Yes
2 ☐ No

6a. Were you working in a position related to science or engineering during the week of February 12–18, 1978?

1 ☐ Yes – *Go to Part III*
2 ☐ No – *Answer 6b*

b. What was the most important reason for taking this position?

Mark only one box

1 ☐ Preferred nonscience or nonengineering position
2 ☐ Promoted out of science or engineering position
3 ☐ Pay was better in nonscience or nonengineering position
4 ☐ Locational preference
5 ☐ Science or engineering position not available
6 ☐ Other – *Specify* _____

(Go to Part III)

7. If you were not employed and not seeking work during the week of February 12–18, 1978, what was your most important reason for not seeking work?

Mark only one box

1 ☐ On vacation or otherwise temporarily absent from a job for health or personal reasons
2 ☐ On layoff from a job
3 ☐ Retired
4 ☐ Student
5 ☐ Tending to family responsibilities
6 ☐ Could not find work or believed no jobs available in my particular field
7 ☐ Other – *Specify* _____

(Go to Part III)

PART III – JOB ACTIVITIES

INSTRUCTIONS

a. Complete questions 8–15 for the job held during the week of February 12–18, 1978, or, if you did not hold a job during that week, complete these questions for your most recent job prior to that week.

b. If you held more than one job, please report only the job at which you worked the greatest number of hours.

Job held during the week of February 12–18, 1978, or most recent prior job.

8. Where did you work?

Write in city and State or foreign country of company, business, agency, or other employer.

City

State or foreign country

9. What kind of business was this?

Enter code and description from Reference List B.

Code | Description from Reference List B

10. What was your occupation?

Enter code and description from Reference List C.

Code | Description from Reference List C

11a. What percent of working time did you devote to each of the following activities?

Entries should sum to 100%.

PLEASE NOTE

Basic research is study directed toward gaining scientific knowledge primarily for its own sake.

Applied research is study directed toward gaining scientific knowledge in an effort to meet a recognized need.

Development is direction of the knowledge gained from research toward production of useful materials, devices, systems, and methods.

01 ____ % Management or administration of research and development

02 ____ % Management or administration of other than research and development

03 ____ % Teaching and training – preparing and teaching courses, guiding and counseling students or trainees

04 ____ % Basic research

05 ____ % Applied research

06 ____ % Development – product, process, and technical development

07 ____ % Report and technical writing, editing, information retrieval

08 ____ % Clinical diagnosis

09 ____ % Design of equipment, processes, models

10 ____ % Quality control, testing, evaluation, or inspection

11 ____ % Operations – production, maintenance, construction, installation

12 ____ % Distribution – sales, traffic, purchasing, customer and public relations

13 ____ % Statistical work – survey work, forecasting, statistical analysis

14 ____ % Consulting

15 ____ % Computer applications

16 ____ % Other activities – *Specify* _____

TOTAL 100%

b. Among all these activities, which was your primary and which was your major secondary work activity?

Fill in the appropriate code numbers (01–16) from question 11a.

Code (01–16 from Question 11a).

Primary work activity

Secondary work activity

12. Which category best describes the type of organization of your principal employment or postdoctoral appointment?

Mark only one box.

01 ☐ Business or industry, including self-employed

02 ☐ Junior college, 2-year college, technical institute

03 ☐ Medical school

04 ☐ 4-year college or university, other than medical school

05 ☐ Elementary or secondary school system

06 ☐ Hospital or clinic

07 ☐ Non-profit organization, other than hospital, clinic, or educational institution

08 ☐ U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA

09 ☐ U.S. Government, civilian employee

10 ☐ State government

11 ☐ Local or other government – *Specify*

12 ☐ International agency

13 ☐ Other – *Specify*

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PART III – JOB ACTIVITIES – Continued

Job held during week of February 12–18, 1978, or most recent prior job

13. What was the basic salary associated with this position? (If not working during February 12–18, report ending salary of most recent prior job.)

If you were on a postdoctoral appointment, include stipend plus allowances. (Basic salary refers to salary before deductions for income tax, social security, retirement, etc. but does not include bonuses, overtime, summer teaching, or other payment for secondary jobs.)

a. $ _____ .00

b. 1 ☐ Per year
2 ☐ Per month
3 ☐ Per week

c. If academically employed, mark whether salary is for –
1 ☐ 9–10 months
2 ☐ 11–12 months

14. Between what dates did you hold this position?
Enter month and year

Consider a change in positions to have occurred if there were significant changes in your duties, level of responsibility, or occupation, even if you continued to work for the same employer.

a. Beginning month and year: _____

b. Ending month and year: _____ OR ☐ Present

15a. Was ANY of your work supported or sponsored by U.S. Government funds?

1 ☐ Yes – *Continue with 15b*
2 ☐ No
3 ☐ Don't know } *Skip to 16a*

b. Which of the following agencies or departments were supporting the work?
Mark as many as apply

01 ☐ AID (Agency for International Development)
02 ☐ Department of Agriculture
03 ☐ Department of Commerce
04 ☐ Department of Defense
05 ☐ Department of Energy
Department of Health, Education, and Welfare
06 ☐ Alcohol and Drug Abuse Mental Health Administration
07 ☐ NIH (National Institutes of Health)
08 ☐ Office of Education
09 ☐ Other HEW – *Specify* ▶ _____
10 ☐ Department of Housing and Urban Development
11 ☐ Department of the Interior
12 ☐ Department of Justice
13 ☐ Department of Labor
14 ☐ Department of Transportation
15 ☐ EPA (Environmental Protection Agency)
16 ☐ NASA (National Aeronautics and Space Administration)
17 ☐ NSF (National Science Foundation)
18 ☐ Nuclear Regulatory Commission
19 ☐ Other agency or department – *Specify* ▶ _____
20 ☐ Don't know source agency or department

PART IV – OTHER INFORMATION

16a. At anytime during calendar year 1977 were you without a job AND actively seeking employment?

1 ☐ Yes – *Continue with 16b*
2 ☐ No – *Skip to question 17*

b. For how many weeks were you seeking employment?

1 ☐ 1 to 4 weeks
2 ☐ 5 to 10 weeks
3 ☐ 11 to 14 weeks
4 ☐ 15 to 26 weeks
5 ☐ 27 weeks or more

17. How many years of professional experience, including teaching, have you had? *Enter number of years*

_____ Years

18. Based on your total education and experience, what do you regard yourself as professionally?
Enter code and description from Reference List C.

Code ☐☐☐ Description from Reference List C _____

19. Listed at the right are selected topics of critical national interest. If you devote a significant proportion of your professional time to any of these problem areas, please mark the box for the one on which you spend the MOST time.
Mark only one box

01 ☐ Health
02 ☐ Environment protection, pollution control
Education:
03 ☐ Teaching
04 ☐ Other
05 ☐ Space
06 ☐ National defense
07 ☐ Crime prevention and control
08 ☐ Food production and technology
09 ☐ Energy and fuel
10 ☐ Other mineral resources
11 ☐ Community development and services
12 ☐ Housing (planning, design, construction)
13 ☐ Other – *Specify* ▶ _____
14 ☐ Does not apply

20a. Are you physically handicapped?

1 ☐ Yes – *Continue with 20b*
2 ☐ No – *Skip to question 21*

b. What is the nature of your handicap(s)?
Mark as many as apply

1 ☐ Visual
2 ☐ Auditory
3 ☐ Orthopedic
4 ☐ Other – *Specify* ▶ _____

21. Is your ethnic heritage Hispanic? (Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture)

1 ☐ Yes
2 ☐ No

22. In the event that it is necessary to contact you to clarify some of the information you provided, may we contact you by telephone?

☐ Yes – *Enter number(s) on which you can be reached* ⟶ Area code | Telephone number
☐ No Area code | Telephone number

23. Please print your name here | **Date prepared**

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REFERENCE LIST A – MAJOR FIELDS OF STUDY

This list is to be used in answering question 3 about the field in which you have obtained study or training. It is divided into two sections. Section I is a list of fields of academic study generally leading to bachelor's or higher degrees. Section II is a list of fields of study and training below those generally leading to a bachelor's degree.

Please scan the entire list, choose the appropriate answer for the question and then enter the code and description in the appropriate section of question 3. If none of the categories listed below adequately describes what you were studying or being trained in, use the "Other" category (code 600 or 625) and enter a brief description of what you were studying in the space provided on the questionnaire.

Section I – FIELDS OF ACADEMIC STUDY LEADING TO BACHELOR'S OR HIGHER DEGREES

Code	Description
	Biological and Agricultural Sciences and Related Fields
501	Agriculture, business
502	Agriculture, general
503	Agronomy, field crops
504	Anatomy and histology
505	Animal physiology
506	Animal science
507	Bacteriology, virology, mycology, parasitology
508	Biochemistry
509	Biology, general
510	Biophysics
511	Botany, general
512	Dairy science (dairy husbandry)
513	Entomology
514	Farm management
515	Fish and game or wildlife management
516	Food science (food technology and processing, dairy manufacturing and technology, food industry)
517	Forestry
518	Genetics
519	Horticulture
520	Immunology
521	Microbiology
522	Plant pathology
523	Plant physiology
524	Soil science (soil management, soil conservation)
525	Zoology, general
526	Biological and agricultural sciences, other fields
	Education
527	Biological sciences education
528	Mathematics education
529	Physical sciences education
530	Trade and industrial training
531	Education, other fields
	Engineering
532	Aerospace, aeronautical, astronautical and related fields
533	Agricultural
534	Architectural
535	Chemical, petroleum refining
536	Civil, construction, transportation
537	Electrical, electronics
538	Engineering sciences, mechanics, physics
539	Engineering technology
540	Environmental, sanitary engineering
541	General or unified
542	Industrial
543	Mechanical
544	Metallurgical, materials, ceramics
545	Mining, mineral, geological
546	Naval architecture and marine engineering
547	Nuclear
548	Operations research, systems engineering
549	Petroleum
550	Engineering, other fields
	Health Fields
551	Medicine or premedicine, and clinical medical sciences
552	Nursing (4 year or longer program)
553	Pathology
554	Pharmacology
555	Pharmacy
556	Health professions, other fields (4 year or longer program)
	Mathematical Sciences
557	Mathematics
558	Statistics and actuarial sciences
559	Computer sciences and systems analysis
560	Operations research/management science
	Physical Sciences
560	Astronomy
561	Chemistry
562	Geography
563	Meteorology
564	Physics
565	Physical sciences, general
565	Geology and geophysics
567	Oceanography
568	Physical sciences, other fields
	Psychology
569	Clinical
570	Educational
571	General psychology
572	Psychology, other fields
	Social Sciences
573	Anthropology
574	Area studies, regional studies
575	Economics, agricultural
576	Economics, except agricultural
577	Foreign service programs
593	Geography
579	History
580	Industrial relations
581	International relations
582	Political science or government
583	Public administration
584	Social sciences, general
585	Social work, social administration, social welfare
586	Sociology
587	Social sciences, other fields
	Arts, Humanities, and Other Specialties
588	Arts, general
589	Business and commerce, including accounting, hotel and restaurant administration, and secretarial studies
590	English and journalism
591	Fine and applied arts, all fields
592	Foreign language and literature, all fields
593	Geography
594	Home economics, all fields
595	Law or prelaw
596	Library science
597	Military science, including merchant marine deck officer
598	Philosophy, all fields
599	Religion and theology, all fields
600	Other *(Describe briefly under the applicable item on the questionnaire.)*

Section II – FIELDS OF ACADEMIC STUDY AND OCCUPATIONAL TRAINING RELATED TO PROGRAMS BELOW THE BACCALAUREATE

Code	Description
	Data Processing-related fields of study or training
601	Computer programming
602	Computer operating
603	All other data processing fields of study or training
	Engineering-related fields of study or training
604	Drafting and design, all fields
605	Aeronautical technology
606	Architectural or building technology
607	Chemical technology
608	Civil technology
609	Electrical and electronics technology
610	Industrial technology
611	Mechanical technology
612	All other engineering-related fields of study or training
	Science-related fields of study or training
613	Agriculture
614	Forestry
615	Other science-related fields of study or training
	Other fields of study or training
616	Business and commerce-related fields of study or training
617	Craft (skilled) occupations-related fields of study or training (such as carpentry, bricklaying, tool and die making, etc.)
618	Educational-related fields of study or training
619	Home economics
620	Nursing and other health service-related fields of study or training
621	Operative occupations-related fields of study or training (such as machine operation, driving, inspecting, etc.)
622	Police technology or law enforcement
623	Sales and marketing-related fields of study or training
624	Service occupations-related fields of study or training (such as cook, beautician, firefighter, etc.)
625	All other fields of study or training *(Describe briefly under the applicable item on the questionnaire.)*

PLEASE DETACH BEFORE RETURNING YOUR COMPLETED QUESTIONNAIRE

FORM PMS-260 9-26-77

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REFERENCE LIST B – KINDS OF BUSINESSES

This list is to be used in answering question 9 about the kind of business or industry for which you worked. Please scan the entire list, choose the appropriate answer for the question and enter the code and description from this list. If none of the categories listed below adequately describes the kind of business for which you worked, use the "Other" category (code 731).

Code	Description
	Manufacturing
701	Aircraft, aircraft engines, aircraft parts
702	Chemicals and allied products
703	Electrical machinery, equipment and supplies for the generation, storage, transformation, transmission, and utilization of electrical energy
704	Electronic apparatus, radio, television and communication equipment and parts
705	Electronic computers, accounting, calculating and office machinery and equipment
706	Fabricated metal products (except ordnance, machinery and transportation equipment)
707	Machinery (except electrical) including engines and turbines, farming and construction machinery, mining, metalworking and other manufacturing and service industry machines
708	Motor vehicles and motor vehicle equipment including trucks, buses, automobiles, railroad engines and cars
709	Ordnance, including manufacture of arms, ammunition, tanks, and complete guided missiles, space vehicles and equipment
710	Petroleum refining and related industries
711	Primary metal industries, including smelting, refining, rolling, drawing, alloying, and manufacture of castings, forgings and other basic metal products
712	Professional and scientific equipment and supplies
713	Other manufacturing including printing and publishing
	Educational Institutions
714	College or university (offering at least a bachelor's degree)
715	Junior college or technical institute
716	Medical school
717	Other educational institutions
	Health Services
718	Hospital or clinic
719	Other medical and health services

Code	Description
	Other Kinds of Business
720	Agriculture, forestry, and fisheries
721	Business, personal, and professional services
722	Construction
723	Engineering or architectural services
724	Finance, insurance, or real estate
725	Mining and petroleum extraction
726	Private, nonprofit organizations other than educational institutions and hospitals
727	Professional and technical societies
728	Research institutions
729	Retail and wholesale trade
730	Transportation, communication, or other public utilities
731	Other *(Describe briefly under the applicable item on the questionnaire.)*
	Public Administration (Include only uniquely governmental activities, such as the U.S. Postal Service, U.S. Air Force, State court, Department of Motor Vehicles, city building inspection, or city public welfare. For example, if you work for the U.S. Postal Service use code 733, Federal public administration; on the other hand, if you work at a Veterans' Administration Hospital, use code 718, Hospital or clinic; if you work at a State university, use code 714, College or university; if you work for a county road building agency, use code 722, Construction; if you work in a Defense Department research laboratory, use code 728, Research institution.)
732	Uniformed military service
733	Federal public administration
734	State public administration
735	Local public administration (city, county, etc.)
737	Regional government
736	Other government

REFERENCE LIST C – OCCUPATIONS

This list is to be used in answering questions 10 and 18 about your occupational classification. Please scan the entire list, choose the appropriate entry and enter the code and description from this list. If you cannot find exactly the right entry, please choose the one that comes nearest to it. If none of the entries is at all appropriate, use the "Other" category (code 475) and enter a brief description in the space provided on the questionnaire.

Code	Description
	Engineers, including college professors and instructors
401	Engineer, aeronautical and astronautical
402	Engineer, agricultural
403	Engineer, chemical
404	Engineer, civil and architectural
405	Engineer, electrical and electronic
406	Engineer, industrial
407	Engineer, mechanical
408	Engineer, metallurgical and materials
409	Engineer, mining, petroleum, and geological
410	Engineer, nuclear
411	Engineer, environmental and sanitary
412	Engineer, operations research systems
413	Engineer, other fields *(Describe briefly under the applicable item on the questionnaire.)*
	Computer Specialist, including college professors and instructors
414	Computer programmer
415	Computer systems analyst
416	Computer scientist
417	Other computer specialist *(Describe briefly under the applicable item on the questionnaire.)*
	Mathematicians and Statisticians, including college professors and instructors
418	Actuary
419	Mathematician
420	Statistician
421	Operations research analyst
	Physical Scientists, including college professors and instructors
422	Chemist
423	Earth scientists including geologists, geophysicists, etc.
424	Physicist, astronomer
425	Atmospheric scientist, meteorologist
426	Oceanographer
427	Other physical scientist *(Describe)*
	Biological Scientists, including college professors and instructors
428	Agricultural scientists, including foresters and conservationists
429	Biological scientist
430	Biochemist
431	Biophysicist
432	Medical scientist, excluding persons who are primarily medical practitioners, **see Health Occupations**
433	Other biological scientist *(Describe)*
	Social scientists, including college professors and instructors
434	Economist
435	Psychologist
436	Sociologist or anthropologist
437	Other social scientist *(Describe briefly under the applicable item on the questionnaire.)*

Code	Description
	Health Occupations, including persons who are primarily practitioners. Persons engaged primarily in medical research, teaching, and similar activities use code 432, Medical scientist.
438	Physician or surgeon
439	Technician, dental
440	Technician, medical
441	Other health occupation *(Describe briefly under the applicable item on the questionnaire.)*
	Technicians and Technologists, except medical
442	Designer, electronic parts and machine tools
443	Designer, industrial
444	Designer, other
445	Draftsman
446	Surveyor
447	Technician, biological and agricultural
448	Technician, electrical and electronic
449	Technician, construction, highways, and architectural
450	Technician, mechanical
451	Technician, other engineering
452	Technician, physical science
453	Technician, other fields *(Describe briefly under the applicable item on the questionnaire.)*
	Teachers
454	Teacher, elementary school
455	Teacher, secondary school
456	Teacher, college and university, **excluding engineering and science** *(Engineering and science teachers see codes 401–437 above.)*
	Administrators, Managers, and Officials, excluding farm
476	Urban and regional planner
457	College president or dean
458	Administrator or manager, scientific and technical research and development
459	Administrator or manager, production and operations
460	Administrator, manager, or official, all other, excluding self-employed
461	Self-employed proprietor
	All Other Occupations
462	Accountant
463	Attorney or judge
464	Sales worker
465	Clerical worker (such as bookkeeper, secretary, etc.)
466	Clergy
467	Craft worker (such as baker, carpenter, electrician, mechanic, repair worker)
468	Farmer (owner, manager, tenant, or farm laborer)
469	Fire fighter or police
470	Laborer, except farm
471	Librarian
472	Merchant or shopkeeper, self-employed
473	Operative (such as assembler, factory worker, miner, welder, truck driver, etc.)
474	Postal worker
475	Other occupations, not specified above *(Describe briefly under the applicable item on the questionnaire.)*

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Appendix D. Source of Data

Characteristic	Table number	Item number on 1978 questionnaire
Age in 1978*	1	(From the 1970 census response)
Sex	1	(From the 1972 survey response, if available; otherwise from the 1970 census response)
Race*	1	(From the 1970 census response)
Residence in 1978	1	A, page 1
Professional identification	1	Part IV, 18
Hispanic heritage	1	Part IV, 21
Occupation in 1978	1	Part III, 10
Highest degree held*	2	2a; otherwise from 1976, 1974, or 1972 survey response
Major field of study for highest degree held*	2	3; otherwise from 1976, 1974, or 1972 survey response
Type of supplementary training: 1977	2	Part I, 4b
Job and occupational mobility: 1976, 1978*	3	1976 survey response and Part III, 10, 14
Job and occupational mobility: 1974, 1978*	3	1974 survey response and Part III, 10, 14
Job and occupational mobility: 1972, 1978*	3	1972 survey response and Part III, 10, 14
Years of professional experience*	3	Part IV, 17
Type of employer	4	Part III, 12
Federal support	4	Part III, 15a, 15b
Unemployment status: 1977	4	Part IV, 16a, 16b
Employment status: February 1978*	4	Part II, 5a, 5b, 7
Full-time employment in science or engineering: February 1978	4	Part II, 6a, 6b
National interest topics	4	Part IV, 19
Industry in 1978	4	Part III, 9
Primary work activity*	4	Part III, 11b
Annual salary rate: 1978	5	Part III, 13

*For more information, see appropriate subject in appendix A.

Appendix E. Response Rates

Table E-1 presents response rates of various components of the sample for the 1978 National Survey of Natural and Social Scientists and Engineers. The characteristics presented here are based on the 1970 census or on the 1978, 1976, 1974, or 1972 surveys. Since the percentages in table E-1 are based on a complete count of the sample cases, no reference to the standard error tables is necessary.

Table E-2 presents distributions of respondents and nonrespondents by the set of characteristics shown in table E-1.

Table E-1 is the counterpart of table E-1 of appendix E of the first report in this series *Selected Characteristics of Persons in Physical Science: 1978*. Table E-1 of that report, however, contained data for 362 respondents whose data were not represented in the tables and text of the report. Table E-1 of this report for engineers excludes data for these 362 respondents.

Table E-1. National Sample, by Field of Science or Engineering in 1976, 1974, and 1972, Age in 1978, and Sex, by Response in the 1978 Survey (Unweighted)

Sex, age in 1978 and field of science or engineering 1976	Response in 1978			
	Total			
	Number	Percent	Respondents	Nonrespondents
Total	50,093	100.0	81.4	18.6
SEX				
Male	46,877	100.0	81.6	18.4
Female	3,216	100.0	78.5	21.5
AGE IN 1978				
Under 30 years	287	100.0	76.0	24.0
30 to 34 years	6,264	100.0	75.7	24.3
35 to 39 years	9,226	100.0	78.1	21.9
40 to 44 years	8,075	100.0	81.3	18.7
45 to 49 years	7,644	100.0	83.1	16.9
50 to 54 years	6,994	100.0	84.9	15.1
55 to 59 years	5,183	100.0	85.8	14.2
60 to 64 years	3,193	100.0	85.5	14.5
65 to 69 years	1,930	100.0	82.2	17.8
70 years and over	1,297	100.0	76.2	23.8
FIELD OF SCIENCE OR ENGINEERING IN 1976				
Respondents in 1976	42,644	100.0	91.8	8.2
Total in scope in 1976	37,602	100.0	92.0	8.0
Computer specialists	2,064	100.0	90.8	9.2
Engineers	19,922	100.0	91.4	8.6
Mathematical specialists	1,486	100.0	92.6	7.4
Life scientists	3,800	100.0	93.9	6.1
Physical scientists	4,695	100.0	93.4	6.6
Environmental scientists	1,749	100.0	92.3	7.7
Psychologists	1,936	100.0	92.1	7.9
Social scientists	1,950	100.0	92.4	7.6
Total out-of-scope in 1976	5,042	100.0	89.8	10.2
Nonrespondents in 1976	7,449	100.0	21.9	78.1
FIELD OF SCIENCE OR ENGINEERING IN 1974				
Respondents in 1974	44,158	100.0	88.9	11.1
Total in scope in 1974	39,473	100.0	89.2	10.8
Computer specialists	2,291	100.0	87.4	12.6
Engineers	20,814	100.0	88.6	11.4
Mathematical specialists	1,612	100.0	89.3	10.7
Life scientists	4,026	100.0	91.0	9.0
Physical scientists	4,824	100.0	91.3	8.7
Environmental scientists	1,867	100.0	88.6	11.4
Psychologists	1 989	100.0	89.0	11.0
Social scientists	2,050	100.0	89.2	10.8
Total out-of-scope in 1974	4,685	100.0	86.2	13.8
Nonrespondents in 1974	5,935	100.0	25.6	74.4
FIELD OF SCIENCE OR ENGINEERING IN 1972				
Respondents in 1972	50,093	100.0	81.4	18.6
Total in scope in 1972	50,093	100.0	81.4	18.6
Computer specialists	3,391	100.0	76.7	23.3
Engineers	25,797	100.0	81.1	18.9
Mathematical specialists	2,185	100.0	81.9	18.1
Life scientists	4,891	100.0	84.1	15.9
Physical scientists	6,248	100.0	84.0	16.0
Environmental scientists	2,095	100.0	82.2	17.8
Psychologists	2,488	100.0	79.9	20.1
Social scientists	2,998	100.0	79.4	20.6

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Table E-2. Respondents and Nonrespondents in the 1978 National Survey, by Field of Science or Engineering in 1976, 1974, and 1972, by Age in 1978, and Sex (Unweighted)

Sex, age in 1978, and field of science or engineering in 1976, 1974, 1972	Responded in 1978		Did not respond in 1978	
	Number	Percent	Number	Percent
Total	40,771	100.0	9,322	100.0
SEX				
Male	38,245	93.8	8,632	92.6
Female	2,526	6.2	690	7.4
AGE IN 1978				
Under 30 years	218	0.5	69	0.7
30 to 34 years	4,739	11.6	1,525	16.4
35 to 39 years	7,208	17.7	2,018	21.6
40 to 44 years	6,565	16.1	1,510	16.2
45 to 49 years	6,354	15.6	1,290	13.8
50 to 54 years	5,939	14.6	1,055	11.3
55 to 59 years	4,445	10.9	738	7.9
60 to 64 years	2,729	6.7	464	5.0
65 to 69 years	1,586	3.9	344	3.7
70 years and over	988	2.4	309	3.3
Median age	45	(X)	43	(X)
FIELD OF SCIENCE OR ENGINEERING IN 1976				
Responded in 1976	39,137	96.0	3,507	37.6
In scope in 1976	34,609	84.9	2,993	32.1
Computer specialists	1,875	4.6	189	2.0
Engineers	18,206	44.7	1,716	18.4
Mathematical specialists	1,376	3.4	110	1.2
Mathematicians	992	2.4	89	1.0
Statisticians	384	0.9	21	0.2
Life scientists	3,568	8.8	232	2.5
Agricultural scientists	1,446	3.5	94	1.0
Biologists	1,720	4.2	112	1.2
Medical scientists	402	1.0	26	0.3
Physical scientists	4,384	10.8	311	3.3
Chemists	2,692	6.6	171	1.8
Physicists and astronomers	1,443	3.5	124	1.3
Other physical scientists	249	0.6	16	0.2
Environmental scientists	1,615	4.0	134	1.4
Earth scientists	1,357	3.3	114	1.2
Atmospheric scientists	187	0.5	13	0.1
Oceanographers	71	0.2	7	0.1
Psychologists	1,784	4.4	152	1.6
Social scientists	1,801	4.4	149	1.6
Economists	750	1.8	70	0.8
Sociologists and anthropologists	484	1.2	38	0.4
Other social scientists	567	1.4	41	0.4
Out of scope	4,528	11.1	514	5.5
Did not respond in 1976	1,634	4.0	5,815	62.4

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Table E-2. Respondents and Nonrespondents in the 1978 National Survey, by Field of Science or Engineering in 1976, 1974, and 1972, by Age in 1978, and Sex (Unweighted)—Continued

Sex, age in 1978, and field in science or engineering in 1976, 1974, 1972	Responded in 1978		Did not respond in 1978	
	Number	Percent	Number	Percent
FIELD OF SCIENCE OR ENGINEERING IN 1974				
Responded in 1974	39,252	96.3	4,906	52.6
In scope in 1974	35,212	86.4	4,261	45.7
Computer specialists	2,003	4.9	288	3.1
Engineers	18,450	45.3	2,364	25.4
Mathematical specialists	1,440	3.5	172	1.8
Mathematicians	1,041	2.6	131	1.4
Statisticians	399	1.0	41	0.4
Life scientists	3,663	9.0	363	3.9
Agricultural scientists	1,491	3.7	159	1.7
Biologists	1,755	4.3	160	1.7
Medical scientists	417	1.0	44	0.5
Physical scientists	4,402	10.8	422	4.5
Chemists	2,713	6.7	251	2.7
Physicists and astronomers	1,409	3.5	145	1.6
Other physical scientists	280	0.7	26	0.3
Environmental scientists	1,655	4.1	212	2.3
Earth scientists	1,399	3.4	176	1.9
Atmospheric scientists	186	0.5	22	0.2
Oceanographers	70	0.2	14	0.2
Psychologists	1,771	4.3	218	2.3
Social scientists	1,828	4.5	222	2.4
Economists	787	1.9	109	1.2
Sociologists and anthropologists	490	1.2	54	0.6
Other social scientists	551	1.4	59	0.6
Out of scope	4,040	9.9	645	6.9
Did not respond in 1974	1,519	3.7	4,416	47.4
Responded in 1972	40,771	100.0	9,322	100.0
In scope in 1972	40,771	100.0	9,322	100.0
Computer specialists	2,600	6.4	791	8.5
Engineers	20,927	51.3	4,870	52.2
Mathematical specialists	1,790	4.4	395	4.2
Mathematicians	1,315	3.2	289	3.1
Statisticians	475	1.2	106	1.1
Life scientists	4,113	10.1	778	8.3
Agricultural scientists	1,720	4.2	305	3.3
Biologists	1,798	4.4	341	3.7
Medical scientists	595	1.5	132	1.4
Physical scientists	5,249	12.9	999	10.7
Chemists	3,061	7.5	583	6.3
Physicists and astronomers	1,791	4.4	337	3.6
Other physical scientists	397	1.0	79	0.8
Environmental scientists	1,723	4.2	372	4.0
Earth scientists	1,553	3.8	345	3.7
Atmospheric scientists	132	0.3	18	0.2
Oceanographers	38	0.1	9	0.1
Psychologists	1,988	4.9	500	5.4
Social scientists	2,381	5.8	617	6.6
Economists	954	2.3	262	2.8
Sociologists and anthropologists	554	1.4	142	1.5
Other social scientists	873	2.1	213	2.3
Out of scope in 1972	-	-	-	-
Did not respond in 1972	-	-	-	-

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